



DOCKET: CU-1962

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: In Cheol PARK et al )  
SERIAL NO: 09/345,270 ) Group Art Unit 2871  
FILED: June 30, 1999 ) Examiner: Q. YU  
TITLE: REFLECTIVE LIQUID CRYSTAL DISPLAY OF HIGH APERTURE  
RATIO, HIGH TRANSMITTANCE AND WIDE VIEWING ANGLE

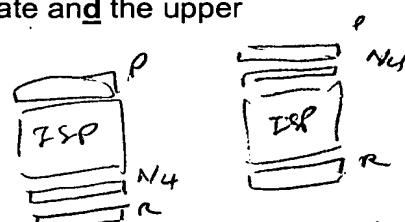
THE ASSISTANT COMMISSIONER FOR PATENTS  
Washington, D.C. 20231

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ART UNIT  
APR 3 2001  
INTER 2800

MARKED VERSION OF CLAIMS 1, 9 AND 14 AS AMENDED

1. A reflective liquid crystal display (LCD) of high aperture ratio, high transmittance and wide viewing angle comprising:
  - a lower substrate and an upper substrate opposed with a selected distance;
  - a liquid crystal layer sandwiched between the lower and the upper substrates and comprising a plurality of liquid crystal molecules;
  - a gate bus line and a data bus line formed on the lower substrate to define a pixel;
  - a counter electrode and a pixel electrode formed at an inner surface of the lower substrate wherein both electrodes are formed with a selected distance and width so that most of the liquid crystal molecules in upper portions of those electrodes are sufficiently driven by forming a fringe field between said counter and pixel electrodes;
  - a thin film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;
  - a polarizing plate disposed at an outer surface of the upper substrate;
  - a reflecting plate disposed at an outer surface of the lower substrate; and
  - a quarter wave plate sandwiched between the [quarter wave] reflecting plate and the lower substrate, or between the polarizing plate and the upper substrate,

ISP



$d_{L-L(SB)}$   $7d_{AP-PE}$

wherein both counter and pixel electrodes are made of a transparent conductor,

wherein a distance between the upper and lower substrates is greater in length than the distance between the counter and pixel electrodes.

9. A reflective liquid crystal display (LCD) of high aperture ratio, high transmittance and wide viewing angle comprising:

a lower substrate and an upper substrate opposed with a selected distance; *d<sub>1</sub>*

a liquid crystal layer sandwiched between the lower and the upper substrates and comprising a plurality of liquid crystal molecules;

a gate bus line and a data bus line formed on the lower substrate to define a pixel;

a counter electrode formed at each pixel of the lower substrate, transmitted with the common signal and having a plurality of branches diverged in parallel with the data bus line and at least a bar for connecting the branches, wherein the respective branches have a first width and they are spaced with a second distance; *w<sub>1</sub>, d<sub>2</sub>*

a pixel electrode having a plurality of strips formed between the respective branches of the counter electrode, having a second width, and spaced apart by a *w<sub>2</sub>, d<sub>3</sub>* third distance, and at least a bar for connecting the strips;

a thin film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;

a polarizing plate disposed at an outer surface of the upper substrate;

a reflecting plate disposed at an outer surface of the lower substrate; and

a quarter wave plate sandwiched between the [quarter wave] reflecting plate and the lower substrate, *or* between the polarizing plate and the upper substrate,

wherein both counter and pixel electrodes are made of a transparent conductor,

wherein a distance between the upper and lower substrates is greater in length than the distance between the branch of the counter electrode and the strip of the pixel electrode,

wherein the first and second widths are set such that the liquid crystal molecules in upper portions of the branch of the counter electrode and the strip of the pixel electrode are aligned by the electric field between adjacent branches and strips.

14. The reflective LCD of Claim 13, wherein the [lengths] dimensions of the first width and the second width are in the range of 2 ~ 8 $\mu$ m respectively.



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CLEAN VERSION OF CLAIMS 1, 9 AND 14 AS AMENDED

*P/C*

*A2*

1. A reflective liquid crystal display (LCD) of high aperture ratio, high transmittance and wide viewing angle comprising:
  - a lower substrate and an upper substrate opposed with a selected distance;
  - a liquid crystal layer sandwiched between the lower and the upper substrates and comprising a plurality of liquid crystal molecules;
  - a gate bus line and a data bus line formed on the lower substrate to define a pixel;
  - a counter electrode and a pixel electrode formed at an inner surface of the lower substrate wherein both electrodes are formed with a selected distance and width so that most of the liquid crystal molecules in upper portions of those electrodes are sufficiently driven by forming a fringe field between said counter and pixel electrodes;
  - a thin film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;
  - a polarizing plate disposed at an outer surface of the upper substrate;
  - a reflecting plate disposed at an outer surface of the lower substrate; and
  - a quarter wave plate sandwiched between the reflecting plate and the lower substrate, or between the polarizing plate and the upper substrate,wherein both counter and pixel electrodes are made of a transparent conductor,

*42 cont*  
wherein a distance between the upper and lower substrates is greater in length than the distance between the counter and pixel electrodes.

*43*  
9. A reflective liquid crystal display (LCD) of high aperture ratio, high transmittance and wide viewing angle comprising:

a lower substrate and an upper substrate opposed with a selected distance; a liquid crystal layer sandwiched between the lower and the upper substrates and comprising a plurality of liquid crystal molecules;

a gate bus line and a data bus line formed on the lower substrate to define a pixel;

a counter electrode formed at each pixel of the lower substrate, transmitted with the common signal and having a plurality of branches diverged in parallel with the data bus line and at least a bar for connecting the branches, wherein the respective branches have a first width and they are spaced with a second distance;

a pixel electrode having a plurality of strips formed between the respective branches of the counter electrode, having a second width, and spaced apart by a third distance, and at least a bar for connecting the strips;

a thin film transistor provided adjacent to an intersection of the gate bus line and the data bus line and transmitting a signal of the data bus line into the pixel electrode when the gate bus line is selected;

a polarizing plate disposed at an outer surface of the upper substrate;

a reflecting plate disposed at an outer surface of the lower substrate; and

a quarter wave plate sandwiched between the reflecting plate and the lower substrate, or between the polarizing plate and the upper substrate,

wherein both counter and pixel electrodes are made of a transparent conductor,

wherein a distance between the upper and lower substrates is greater in length than the distance between the branch of the counter electrode and the strip of the pixel electrode,

wherein the first and second widths are set such that the liquid crystal molecules in upper portions of the branch of the counter electrode and the strip of

*A3 cont*  
the pixel electrode are aligned by the electric field between adjacent branches and strips.

*SC 4*  
14. The reflective LCD of Claim 13, wherein the dimensions of the first width and the second width are in the range of  $2 \sim 8 \mu\text{m}$  respectively.